Is it an ODE or a PDE? (That is, does it take a derivative with respect to more than one variable?)

ODE

What is the order? (That is, the order of the highest derivative)

First order: \( y' = f(x, y) \)

Is it linear or nonlinear? (usually we assume this to mean linear in \( y \)...) linear: \( y' + p(x)y = g(x) \)

Can you find an integrating factor?

yes

want to multiply entire equation by \( \mu(x) \), and choose \( \mu(x) \) so left side of equation is like the product rule: \( \mu y' + \mu py = (\mu y)' \)...

ODE

PDE You need another class!

Higher than first

Coming Soon (to a lecture near you...)

Is it separable? \( M(x) + N(y)y' = 0 \)

yes

Integrate it!

no

Find \( \psi : \psi_x = M, \psi_y = N \), Solution is \( \psi(x,y) = c \).

Is it exact? \( M_y = N_x \)

yes

Invert it (write in terms of \( dx/dy \), use integrating factors!)

no

Maybe its linear in \( x \)?

yes

Change variables: \( v = y/x \). Now it’s separable!

no

Can you write it as \( y' = f(y/x) \)?

yes

Find \( \mu(x) \) or \( \mu(y) \) to make it exact!

no

Can you make it exact? \( \frac{M_y - N_x}{M} = \text{fn of } x \) or \( \frac{N_y - M_x}{N} = \text{fn of } y? \)

yes

Any other ideas?

yes

Try them!

no

Well Darn. Give up now. (in terms of finding a solution we can write down...)